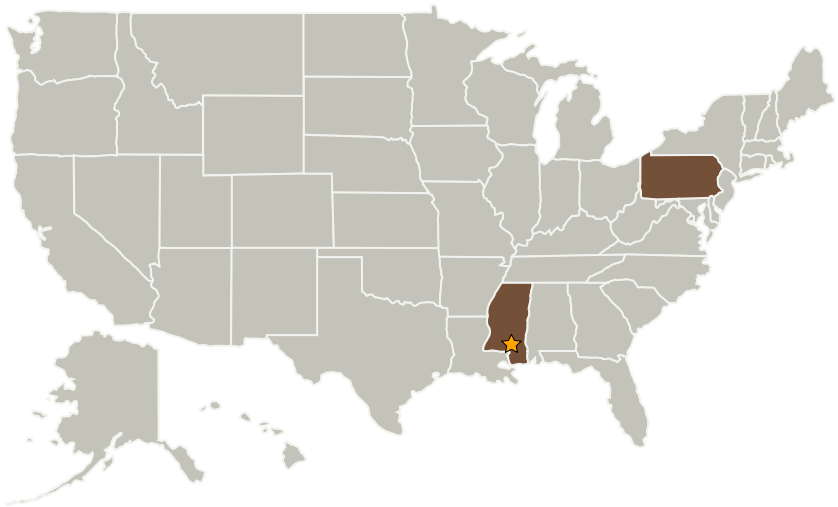
Computational Modeling in Support of High Altitude Testing Facilities, Phase I

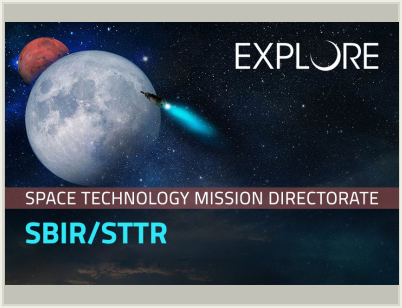
Completed Technology Project (2007 - 2007)

Project Introduction

Simulation technology plays an important role in rocket engine test facility design and development by assessing risks, identifying failure modes and predicting anomalous behavior of critical systems. Advanced numerical tools assume greater significance in supporting testing and design of high altitude testing facilities because of the greater inter-dependence and synergy in the functioning of the different sub-systems. This is especially true for J2-X testing because of a challenging operating envelope linked to variable throttle conditions at relatively low chamber pressures. Facility designs require a complex network of diffuser ducts, steam ejector trains, fast operating valves, spray nozzles and flow diverters that need to be characterized for steady state performance. More importantly, integrated facility designs will also have to be evaluated for startup/shutdown transients that can trigger engine unstart modes leading to catastrophic failure. The proposed innovation expands on the multi-element unstructured CFD which has been validated for complex valve/feed systems and high pressure propellant delivery systems used in engine and component test stands at NASA SSC. The focus here will be on extending this capability to include advanced models for supersonic diffuser design, steam ejector performance, spray nozzle cooling efficiency, plume aspiration dynamics and isolation valve operation.

Primary U.S. Work Locations and Key Partners





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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Stennis Space Center (SSC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Stennis Space Center(SSC)	Lead Organization	NASA Center	Stennis Space Center, Mississippi
CRAFT Tech - Combustion Research and Flow Technology	Supporting Organization	Industry	Pipersville, Pennsylvania

Primary U.S. Work Locations	
Mississippi	Pennsylvania

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX13 Ground, Test, and Surface Systems
  - TX13.2 Test and Qualification
    - TX13.2.1 Mechanical/Structural Integrity Testing